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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/629,618	07/31/2000	Mitsuaki Kabasawa	P107443-00007	4227

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EXAMINER

SOUW, BERNARD E

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 07/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/629,618

Applicant(s)

KABASAWA, MITSUAKI

Examiner

Bernard E Souw

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☒ Claim(s) 1,2,6-9,15,17,18,20 and 23 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 July 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. The disclosure is objected to because of the following informalities:
 - On page 9/lines12-13: The sentence, "When ~~a~~ neutralization rate is not so large, ~~an~~ amount of the neutralized beam is proportional to ~~a~~ quantity or amount of ~~an~~ original beam (...)", does not sound right. Better would be, "When ~~a~~ **the** neutralization rate is not so large, ~~an~~ the ~~amount~~ **intensity** of the neutralized beam is proportional to ~~a~~ quantity or amount **the intensity** of ~~an~~ the original beam (...)".

On page 13/lines 12-18: The following (a)-(b)-(c) sequential sentences, "(a) In addition, the Faraday disc 14 (....) is placed just after the wafer disc; (b) If the electric current values measured by the respective Faraday cups 12 and 14 are compared with each other, the beam transportation efficiency ~~is~~ can be calculated from the electric current values; and (c) By moving the wafer disc in up-and-down direction in Fig.2, a scanning operation can be performed (...)", are not in a logical sequence. Better understandable would be to arrange the sentences according to an (a)-(c)-(b) sequential order.

Appropriate corrections are required.

Claim Objections

1. Claim 17 is objected to because of the following informalities:

→ “comparing the measured value of the beam ~~transportation~~ efficiency with ~~the a~~ predetermined allowable lower limit ~~value~~”.

2. Claim 18 is objected to because of the following informalities:

→ “mass analysis slit is variable in ~~a slit~~ width”

3. Claim 22 is objected to because of the following informalities:

→ “impinge ~~to~~ a wafer” → “impinge **onto** a wafer” or “impinge **on** a wafer”.

4. Claim 22 is further objected to because the wording does not particularly point out what is really claimed. It would be better expressed as “(...) before the ~~beam starts to impinge to~~ implantation process begins.

Appropriate corrections are required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 1 is rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The recited “*means for **measuring** (....) **beam energy** (.....)*”, which would be critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188

USPQ 356 (CCPA 1976). In addition, the recited “means for obtaining a beam **transportation efficiency** (.....) **from the beam energy measured** (at)”, is also not enabled by the disclosure.

As generally known in the art, *beam energy* -- conventionally measured in units of [electron-volts] -- is completely different than, and has nothing to do with, (ion) *beam current* described in the specification of Applicant's invention. It is understood by one of ordinary skill in the art, that, to obtain or calculate ion transport(ation) efficiency according to Applicant's Eqs.1-6 on pg. 9-11, one would need (and measure) the **ion beam current** (denoted by I_{xx} in the equations) **instead of ion beam energy**.

Thus, while ion beam current is indeed needed to calculate transport(ation) efficiency according to Applicant's method described in the specification on pp.9-11 by virtue of Eqs. 1-6, this ion beam current *can not be obtained or derived* from beam energy measurements, unless some additional measures are also taken, such as, e.g., time-of-flight measurements using timing circuits in the case of repetitively pulsed ion beam, and multiple or position-variable analyzer slits, or variable electric or magnetic deflectors in the case of cw ion beams, as generally known by ordinarily skilled in the art. This Official Notice is supported, e.g., by Marushita (JP-05182795A), Kaneko et al. (JP-04101400A), McIntyre et al. (USPAT # 6137112), and in IBM Technical Disclosure Bulletin 20/10, pp.3886-3888). *None* of such additional measures is disclosed in Applicant's invention.

The Applicant is advised not to confuse his own terminology of “*energy contamination*” (which should correctly read “*contamination by high energy neutrals*”)

with (a necessity to measure) the beam energy. The Applicant is also cautioned not to introduce New Matter in obviating this 35 U.S.C. § 101 first paragraph rejection(s).

To proceed with this Office Action, corrections in relevant limitations are readily introduced by the Examiner in consequent of the above 35 U.S.C. 112, first paragraph rejection.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1, 2, 6-9, 15, 17, 18, 20 and 23, are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

► Regarding claim 1, the limitation of “*means for **measuring**, along the predetermined path, **beam energy** at a plurality of measurements positions different from each other*”, is not supported by the specification.

► Regarding claim 2, the phrase “*a **rate** of a neutral **beam** to the **beam***” contains two indefinitenesses: (1) the subject is unclear/indefinite, is it *a **rate*** or *a **beam*** ? And furthermore, (2) “*a **rate** of a (...) **beam** to the **beam***” is incomprehensible, hence indefinite.

► Regarding claim 6, the phrase “the energy contamination is *determined with a reference* to a deceleration rate based on the ion deceleration electrode” contains two indefinitenesses: (1) what kind of ***reference***? (2) the alternative interpretations, either “a contamination (...) *based on* the ion deceleration electrode” or “a deceleration rate

based on the ion deceleration electrode” are both incomprehensible, thus rendering the claim indefinite.

► Regarding claim 7, the phrase “*deciding a target value in a wafer related to an amount of energy contamination*” is incomprehensible, and hence, indefinite. To proceed forward with this Office Action, the phrase is understood by the Examiner as “a target value **of energy contamination** in a wafer ~~related to an amount of energy contamination~~”

► Regarding claim 8, the phrase “*judging whether or not (....) is to be judged with reference to a target value (....)*” is not comprehensible, and hence, indefinite: What kind of *judgment* and what kind of *reference* are here meant by the Applicant?

► Regarding claim 9, the phrase “*(..) to decrease a **rate of a neutral beam to a beam***” is incomprehensible, and hence, indefinite. Furthermore, any method or step to *decrease* or *enhance* a rate (or anything else) **must** involve at least two separate & comparative actions. However, the wording used in the claim, “*setting (...) to a predetermined value (...)*”, unambiguously involves only *one single* action, rendering the words “decrease” or “enhance” improper, and the claim indefinite.

► Regarding claim 15, the phrases (1) “the implantation is **not** carried out by *comparing* (..) with (..)” and further, (2) “by *detecting* that the former value does not exceed (...)”, are both incomprehensible and hence indefinite: An implantation is a *physical action*, and hence, can not be carried out by *comparing* something with anything, the latter being essentially a mental or intellectual action. Furthermore, a value can only be **detected as it is**, i.e., either exceeding or not exceeding a target

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value, either desired or undesired. The Applicant may here mean, "by ~~detecting~~ making sure that (....)".

In addition, a claim shall not be limited in a negative sense (by using the word "**not**"), because the number and types of implantation methods that belong to this "not" category would diverge to infinity, thus rendering the claim indefinite.

► Regarding claim 17, the limitation that "**displaying an error message (....) so as to automatically tune the ion source and the beam transportation system**" is violating the causality principle.

► Regarding claim 18, the phrase "the mass analysis slit is variable in width, which adjusts the beam **on tuning the beam transportation system**" is incomprehensible and hence indefinite. To proceed with this Office Action the phrase is interpreted as "(the mass analysis slit is variable in width), **which can be used to adjust and/or tune the beam-transport system**"

► Regarding claim 20, the phrase "automatic switching is made to a mass analysis slit of a minimum width on tuning a beam transportation system to adjust a beam axis and to adjust a coil electric current of an analyzer" is incomprehensible and hence indefinite.

Does the Applicant mean, "~~automatic switching is made to~~ a mass analysis slit **is automatically adjusted to** of a minimum width ~~on tuning~~ tune a beam-transportation system, **i.e.,** to adjust a **the** beam axis and ~~to adjust a coil~~ **the** electric current of an analyzer **coil** ?

► Regarding claim 23, the phrase "a specified *value* which serves as the allowable lower limit *value* is set in compliance (...)" is indefinite: **what limit, or what value?**

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 4 is rejected under 35 U.S.C. 101 because it is directed to a non-statutory subject matter, in this case a physical law. The explicit limitation that *"the correlation is specified by an inverse proportion relation between the energy contamination and the beam transportation efficiency"* is nothing else than a physical law, which is furthermore well known in the pertinent art through the fact that energy contamination is mainly determined by (and also proportional to) the quantity, intensity, and/or rate, of neutralized ions. It is then obvious to a person of ordinary skill in the art, that, in order to have an energy contamination not exceeding a predetermined/desired (upper) limit, the beam transport(ation) efficiency has to satisfy a corresponding criterion, or limit.

Support for this Official Notice is given, e.g., by Adibi et al. (USPAT # 5,883,391) in Col.2/ll.51-63, Col.3/ll.35-36, Col.5/ll.51-54, Col.8/ll.4-16, and more specifically in , Col.3/ll.2-14 with regard to a predetermined limit for neutral beam current.

Further claims that partly comprise the same limitations are claims 2, 7, 8, 12, 13, 17, 23 and 24. In the following, these (partial) limitations will be addressed by referring them as a physical law, which is rejected for being well known to one ordinarily skilled in the art.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adibi et al. (USPAT # 5,883,391).

10. Regarding claim 1, insofar the Examiner can ascertain beyond the above rejections under 35 U.S.C. § 112, 1st and 2nd paragraphs, Adibi et al. disclose an ion implantation apparatus and a method of monitoring high energy neutral contamination in an ion implantation process, as recited in the title. Adibi's ion implanter, as illustrated in Fig.1, comprises (correction introduced by the Examiner to obviate a previous 35 U.S.C. 112, first paragraph rejection):

(a) means for measuring, along predetermined path, **neutral beam (energy) current** at a plurality of measurement positions, i.e., at/by a field electrode 61, as recited in Col.2/ll.51-63, Col.3/ll.2-14, Col.3/ll.35-36, Col.5/ll.51-54, Col.8/ll.4-16, and at/by an ion beam collector 14 positioned downstream of the target wafer 12, as recited in Col.4/ll.33-41.

(b) means for obtaining a beam transportation efficiency between the measurement positions from the beam ~~(energy)~~ **currents** measured at the respective measurement

positions, *the beam transportation efficiency being here obtained from dividing the neutral beam current measured by electrode 61, by the ion beam current measured by ion beam collector 14 (prior to inserting the target wafer 12).*

(c) means for reducing energy contamination implanted in the wafer 12 by using a correlation between the energy contamination implanted into the wafer and the ***neutral beam current***, as recited in Col.2/II.51-63, Col.3/II.2-14, Col.3/II.35-36, Col.5/II.51-54, Col.8/II.4-16, whereby a direct value of neutral beam current is measured and used by Adibi-1 to determine & reduce the energy contamination, instead of over the transport efficiency as suggested by the Applicant, the latter being essentially obsolete because of Applicant's failure for deriving *beam currents* for use in Applicant's own Eqs.1-6 from *beam energy* measurements. Note that Adibi's neutral beam current is essentially equal to Applicant's neutral current defined in Applicant's Eq.1 (up to a proportionality constant to be obtained from preliminary measurements).

It would have been obvious to one of ordinary skill in the art by the time the invention was made to indirectly measure the neutral beam equivalent-current from its known proportionality to the ion beam current at the target wafer, and then derive the *energy contamination* over the transport(ation) efficiency, instead of measuring the neutral beam equivalent-current over the slow ions originating from charge exchange processes using a field electrode, as suggested by Adibi et al., since it is well known to one of ordinary skill in the art that the degree of *contamination by high energy neutrals* is proportional to the neutral beam equivalent-current, and hence, the two methods are equivalent alternatives.

11. Regarding claim 2, Adibi's apparatus has an intermediate convergent point or mass analysis slit 39, 41, 43, for converging the beam within the predetermined path, as recited in Col.4/ll.64-67, wherein one of the measurement positions is determined at a front or rear position of the intermediate convergent point or the mass analysis slit at 43, the apparatus being adjusted at the one of the measurement positions so that the neutral beam current (measured by electrode 61) is not higher than a predetermined rate, or current, as recited in Col.3/ll.2-14.

12. Claim 3 recites the same limitations of the previously rejected claim 2, with an additional limitation that the correlation data is stored (in a computer), the latter being (parts of) an automation. In this regard, the court held that broadly providing mechanical or automatic means to replace manual activity which has accomplished the same result involves only routine skill in the art. *In re Venner*, 120 USPQ 192.

13. Regarding claim 4, in observance of the above rejection under 35 U.S.C. 101, an inverse proportion relation between the energy contamination and the beam transport efficiency (as determined in the rejection of claim 1 above) is established in Adibi's apparatus, because it is a consequence of natural law (conservation of particle number & charge), as well known to those ordinarily skilled in the art.

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14. Regarding claims 5, 7-10, Adibi's ion implantation apparatus shown in Fig.1 comprises an ion source 3, an extraction electrode 21, 23, a mass analysis unit 5, a mass analysis slit 39, 41, 43. a wafer processing chamber (trivial) enclosing the target wafer 12, an intermediate convergent point 39, 41, 43, as already applied to claim 2 above, whereas Adibi's ion implantation method includes limitations over the beam transportation efficiency and its correlation to energy contamination, all having been applied in the rejection of claim 2 above.

15. Regarding claims 6, 12, 13 and 19, Adibi's apparatus has a deceleration unit comprising deceleration electrode 65, as recited in Col.5/ll.55-56, whereas the recited relation between beam transportation efficiency and the energy contamination has been previously addressed in the rejection of claim 2.

Claim 19 recites that the mass analysis slit is used also as a deceleration electrode. This limitation is a viable alternative to Adibi's deceleration system well known to one of ordinary skill in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the deceleration voltage not to the deceleration electrode 65, but instead, to the mass analyzing slit 39,41, since it is the voltage difference which is responsible for a deceleration/acceleration as needed to generate ion beams of lower energies.

16. Regarding claims 11, 14, 15, and 21, Adibi's apparatus has a first charge measuring device 61 (as a replacement of a Faraday cup, as generally known in the art), that is located at a front or rear of either an intermediate convergent point or a mass analysis slit 39,41,43; Adibi's apparatus further has a second measuring device or Faraday cup 14 positioned at a rear position of a wafer 12, as shown in Fig.1 and recited in Col.4/ll.23-41 and Col.8/ll.4-16.

The remaining limitations of claims 11, 14 and 15 are the same as (parts of) the previously rejected claim 2.

17. Regarding claim 16, means for tuning the ion source and a beam transportation system are inherent in all ion beam systems, including Adibi's.

18. Claim 17 recites the same limitation as claim 2 and part of claim 7, which have been previously rejected. The further limitations of "stopping the implantation in the case the measured value does not exceed the predetermined allowable value, and the recitation of a means for displaying an error message in the case where the implantation is stopped ~~so as to~~ **such that automatically tuning can be performed**", are recited in Col.8/ll.22-34. Moreover, such limitations belong to automation, which are here rejected (as also claim 3 above) because they involve only routine skill in the art. *In re Venner*, 120 USPQ 192.

19. Regarding claim 18, the width of Adibi's mass analysis slit system 39,41, is adjustable, as recited in Col.5/ll.2-9.

20. Claim 20 recites limitations which are essentially an automation of tuning the beam transportation system, and is therefore rejected because they involve only routine skill in the art. *In re Venner*, 120 USPQ 192.

21. The limitations of claim 22 are trivial and inherent to Adidbi's method.

22. Regarding claim 23, the limitations are the same as (parts of) claims 2, 5, and 7-10, which have been previously rejected.

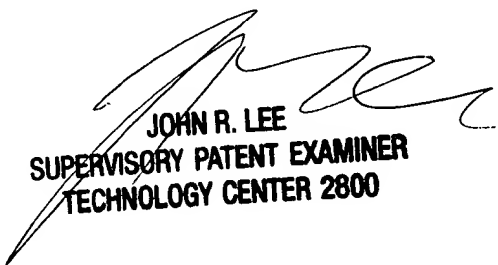
23. Claim 24 recites limitations that comprise a combination of claims 2 and 3, which have been previously rejected.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 703 305 0149. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9318 for regular communications and 703 872 9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes
June 24, 2002



JOHN R. LEE
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